Altered motor control, posture and the Pilates method of exercise prescription

Dorothy Curnow

Master of Arts (Performance) University of Western Sydney

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Abstract

Aims

- To determine whether a basic set of Pilates exercises improves the efficiency of load transfer through the pelvis
- To compare the effects on chronic, mild low back pain (LBP) symptoms of three slightly different Pilates based regimes

Methods

A between subjects equivalent group experimental design was used

- Independent variable: type of exercise training (three groups)
- Dependent variables: efficient load transfer through the pelvis as measured by the stork test in weight bearing; low back pain symptoms

At entry, to establish baseline values, subjects completed an Oswestry Disability Questionnaire and recorded the frequency, intensity and duration of their back pain in an average week. Also, a Stork test was recorded.

Thirty-nine volunteers with mild chronic low back pain (CLBP) were taught four Pilates based exercises before being randomly allocated to one of three groups for the addition of other interventions.

- Groups A received four basic exercises
- Groups B and C received an additional relaxation posture using a specific spinal support
- Group C received an additional postural training exercise

Exercises were performed three times per week for six weeks and recording was done once per week for eight weeks. For each of the eight weeks, subjects recorded frequency, intensity and duration of back pain

At the final assessment, subjects completed another Oswestry Disability Questionnaire, returned their recording sheets, had a stork test recorded and their exercises checked.

Results

Oswestry Disability Questionnaire

Pre and post comparison of answers showed only one statistically significant improvement among subject groups. This was for question one, '*Do you have back pain at present?*' where Group B reported significantly less pain post program compared with pre program (Wilcoxon, z=-2.496, p=0.013).

Number of days of pain

Group B experienced a statistically significant reduction in the number of days of pain between Week 1 and Weeks 6 to 8 ($F_{7,84}$=6.4, p=0.0001). Post hoc analysis using Scheffé showed significant differences between Week 1 and Weeks 6, 7 and 8 and between Week 2 and Week 8 ($p<0.05$). There were statistically significant differences by week within Group C ($F_{7,77}$=3.29, p=0.0041), but they only show up with Fisher ($p<0.05$) and they were between Week 1 and Weeks 6, 7 and 8, Week 2 and Weeks 6, 7 and 8, Week 3 and Weeks 6 and 7 and between Week 4 and Week 7.

Some of the improvements were lost once exercising ceased at the end of week 6

Duration of back pain episodes

All groups experienced a reduction in the mean length of the shortest, longest and average pain episodes. At week eight all groups had subjects who were pain free (Group A: 7.7%, Group B: 30.8%, Group C: 25%) and in Group B, no subjects reported pain episodes longer than six hours. However, differences were not statistically significant for the duration of this study.

Some of the improvements were lost once exercising ceased at the end of week 6

Intensity of pain across all lengths of pain episodes

While, all groups experienced a reduction in the intensity of pain across all lengths of pain episodes, the only statistically significant inter group difference involved Group A and Group B on the shortest pain episodes at Week 6, with Group B experiencing a greater reduction in pain intensity than Group A (Kruskal Wallis, p=0.02)

And for all groups, intensity of pain tended to rise once exercising ceased

Stork test in weight bearing

These results were inconclusive and this could have been because total subject numbers were small. As the same person carried out all tests, it was unlikely to reflect changes in measurement method or interpretation. However, it did raise questions regarding the stance for commencement of the test and this led to an investigation to assess the importance of the stance to the test results.

Procedure

A physiotherapist, experienced in taking Stork tests, who was not aware of the purpose of the test, carried out the stork tests. Ten subjects stood in three different standing positions to commence the test and neither subjects nor standing positions were tested consecutively.

- Not one subject had the same result recorded from all three positions
- There was no pattern to the results observed
- Two subjects had different results recorded from all three positions

Observations

- For correct execution of the exercises:
  - Subjects required follow up supervision
  - Those who had more individual attention learnt faster than those who had less
  - Understanding the intent of the exercise was more important than other factors such as age

- During periods of nonpractice correct execution was quickly forgotten

- Good acceptance of the program - 95% of the subjects decided to continue
  - However, compliance became an issue – the fewer the LBP symptoms, the less likely the subjects were to comply

Conclusions

Current pain symptoms (Oswestry Disability Questionnaire) showed a reduction in pain and all groups experienced statistically significant reductions in the frequency, duration and intensity of pain across the weeks of exercising. However, effects were not statistically significant between the groups, except for one instance.

Results indicate that other factors such as postural training and relaxation may impact on exercise programs and as the psoas muscle was the intended target for relaxation and training, it may indicate its importance in exercise rehabilitation.

Consistency of practice, supervision and follow up are important for correct exercise execution and once exercising ceases, reductions in LBP symptoms tend to diminish.

Stork test results and subsequent examination suggested that further investigation of the testing process was necessary and a further study was designed.

Aim of the stork test study

- To examine whether changing the stance of the starting position for the stork test on the weight-bearing leg altered the test outcome.

Methods

Seventy-four healthy, mobile adult volunteers took part. The exclusion criteria were stroke, spinal fusion, significant scoliosis, antalgic gait, hip or knee replacement or significant leg length difference. Subjects could suffer from minor ailments, including low back pain.

It was a within subjects experimental design with the independent variables being the four different stances for the commencement of the test and the dependent variable being the stork test which was measured using thumb locations on the posterior superior iliac spine and the second sacral spinous process.
All 296 tests were videoed and subsequently reviewed on a computer screen using a horizontal grid to identify the vertical direction and relative distance of thumb movement.

Results

Consistency between stance pairs was at best fair, with Kappa values ranging from $\kappa = -0.03$ to $\kappa = 0.34$. In conclusion, the starting stance influenced the outcome of the stork test with more than 64% of subjects failing to have consistent results across all four stances.

Discussion

For a comparable stork test measurement pre and post treatment, the same starting stance should be used. In addition the study showed that:

- The thumb on the innominate could rise, lower or remain at the same level
- The thumb on the sacrum could rise, lower or remain at the same level
- These movements could be independent

Thus, it is important to take note of the relative movement between the innominate (os coxa or pelvic bone) and sacral thumb positions since these can move independently during the test.

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Contents

Appendices

Publications to date

Curnow, D. Cobbin D. Wyndham J. Choy STB. Altered motor control, posture and the Pilates method of exercise prescription. Proceedings of the 6th Interdisciplinary World Congress on Low Back & Pelvic Pain Barcelona, Spain 2007

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